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OBSERVATIONS ON SOME AMERICAN FORMS OF
CHARA CORONATA.

BY T. F. ALLEN, M.D.

Chara coronata Ziz. (in ed. 1814), revised by A. Braun to include all known varieties, belongs to the second division of the genus *Chara*, namely *Haplostephanæ* (stipules composed of a simple series of cells); it has but one stipular cell at the base of each leaf, is not corticated, is monœcious and is described as follows in Braun's *Characeæ Africanæ*: "Plant annual, smooth and flexible. *Leaves* verticillate nine to eleven, with 4-6 articulations, 3-5 elongated segments and a short mucroniform ultimate segment. *Bracts* developed at every node; at the terminal node forming with the terminal segment a 3-5 divided crownlet (coronula); the posterior bracts shorter, depauperate or wholly wanting; the anterior about equaling the sporangium, rarely longer, often shorter. *Stipules* about the size of the leaves. *Antheridia* and *Sporangia* produced on the same node, rarely double or triple. *Nucleus* of the sporangium black, with a calcareous shell and with 7-12 conspicuous striæ on a side."

The European form of this species, known as var. *Braunii*, has been considered the normal form, occupying as it does an intermediate position in respect to size, development of bracts, size of nucleus and form of the coronula. The nucleus varies from 420 to 550 μ . (micro-millemeters, mille-millemeters) in length, is 9-striate; coronula of the sporangium is short and obtuse; the bracts anteriorly are equal to or shorter than the sporangium, posteriorly they are undeveloped. This form is found also in America, but the more distinctively American form has been known as var. *Schweinitzii* A. Br. This is usually characterized by a larger nucleus, 550 to 650 μ ., and by the great development of the bracts, which are often several times longer than the sporangium and are completely developed around the leaf, verticillate, though the posterior are much shorter than the anterior. An African form, var. *Perrottetii* A. Br., has a large nucleus, 600-650 μ ., with unilateral bracts equaling in length the sporangium; this form we find in America also. From India, var. *Coromandelina* A. Br., has been designated by a very large nucleus 600-750 μ ., with verticillate bracts, nucleus with seven strong angles; some of our forms approach very closely to this,

having verticillate bracts and an equally large nucleus. In the Sandwich islands is found a delicate form in which the cells of the coronula are much elongated, and approaching this form is one collected in New Mexico by Wright. Besides the more distinct forms are many intermediate forms, difficult to place, possessing characters belonging to two or more varieties; indeed the forms of this species from different places are quite numerous. We find the plant everywhere from Canada to Mexico and from Massachusetts to California.

One interesting fact is, that the plant in any given locality is constant in its peculiarities, and though thousands of plants be examined they will all be found to exhibit precisely the same character. This is true not only of this species but of most other species of Characeæ; thus in a pond filled with *Chara fetida* A. Br., with long bracts and long terminal naked nodes (Macroptila, Macroteles) all the plants will have the same peculiarity and will keep it unchanged year after year, while a neighboring pond perhaps only a few rods distant, may be inhabited by another distinct but persistent form.

A. Braun relates that *Chara gymnopus* var. *Humboldtii* A. Br., collected by Gollmer in the same lake in which fifty-five years before Humboldt had gathered it, presented precisely the same characters. We have, however, noticed in one instance an apparent difference in a form of *C. coronata* collected in precisely the same locality in which it had been found twenty years before, but there might have been a difference in the maturity of the plants. This permanence of slight peculiarities may be owing to the disagreeable odor and taste of the plant, which has often a strong smell of sulphuretted hydrogen, rendering it offensive to animals who might otherwise feed upon it and carry the seeds to other localities; and as the plants grow wholly under water, the seeds are not liable to be carried by the wind. Hybridization seems, therefore, to be infrequent and exceptional. These very qualities, which serve to limit the spread of the Characeæ, may also have determined the persistence of very ancient forms and limited their multiplication.

The characters relied upon for distinctions between varieties, have been the development of the bracts, the size and striation of the nucleus, and the character of the coronula of the sporangium. The general aspect of the plant, size and length of stem, density

or laxity of growth, seems to vary greatly from differences in the character of the water, exposure, et cetera. The plant has been thought to be free from incrustation, but one form from Canada (Pacific Railway survey) is so completely incrustated that it is extremely brittle, and when dry has a gray color; while another form has a most peculiar zonular incrustation, giving the plant a variegated appearance.

The development of bracts seems to be most capricious; though the comparative length of bracts and sporangia seems to be pretty constant in any one locality, the *posterior* development varies in a single plant, and at times on a single leaf, one node exhibiting verticillate bracts while the next node has absolutely no bracts on its dorsal aspect: this we often find to be the case in the longest bracted forms (var. *Schweinitzii*).

In America we have every length of anterior bracts from two to three times the length of the sporangium, a little longer, of equal length, a little shorter, to very short bracts, one-half or even a third its length. Some of the shortest bracted forms are found with the largest sporangia and with verticillate bracts.

Size of nucleus.—The smallest, mature nucleus we have yet met with occurs in the form collected by Wright in New Mexico, and determined by A. Braun as var. *Braunii* forma *tenera*; it is 420 μ . long and has seven striæ; next in order is the Silver-city form, recently found, 500 μ . with only five striæ; one from California is 500 μ . long with seven striæ; from Saranac lake, Vermont, N. Carolina, etc., are forms 520 to 550 μ . long with longer or shorter bracts; then come the more common long-bracted forms (var. *Schweinitzii*) with nucleus 550 to 650 μ . long with 8 to 9 striæ; then some forms with larger nucleus and very short bracts, Penn. and Kansas, 660 to 780 (!) long with 9 to 10 striæ. Both the smallest and largest nuclei now known to us, have been associated with short bracts.

The number of striæ on the nucleus, representing the whorls of enveloping cells, varies considerably; while in a general way they are more numerous on the longest nuclei, yet a smaller nucleus may have more than one somewhat larger; the delicate Saranac form has 9 striæ, while the larger Vermont form has only 7 (the same as the delicate *Braunii-tenera*) though the nucleus is larger. The Silver-city form with a nucleus 500 μ . long has 5 striæ, while *Braunii-tenera* nucleus 420 μ . has 7 striæ.

The cells of the coronula vary greatly from the closely-set short cells of the more common forms to the divergent and elongated cells of *Braunii-tenera*, which exhibits an approach to the Sandwich island form (var. *Oahuensis* A. Br.).

These varying characters with their numerous combinations seem to us to render a division of the species into definite varieties well nigh impossible. As it has now become unadvisable to bestow distinctive names upon the numerous forms of that truly polymorphic species *C. fetida* A. Br., so in view of the now numerous and rapidly multiplying forms of *C. coronata*, it seems to us proper to describe them as *forms* peculiar in many cases to certain localities.

The variations of this plant may be tabulated as follows, giving prominence to the size of the nucleus and length of the bracts, allowing also for variations in the habit of growth, et cetera :

I. *Microcarpa*, nucleus less than 500 μ . in length.

1. *Macroptila*, bracts longer than the sporangia, verticillate or unilateral.
 - a. *Condensata*, verticils approximate, the leaves longer than the internodes.
 - b. *Laxior*, leaves loose, spreading.
 - c. *Clausula*, leaves compact, incurved.
- A. *Pachygyra*, nucleus with thick prominent angles.
- B. *Leiopyrena*, nucleus smooth, or with but slightly prominent angles.
2. *Microptila*, bracts shorter than the sporangium, verticillate or unilateral.
 - a. *Condensata*.
 - b. *Laxior*.
 - c. *Clausula*.
- A. *Pachygyra*.
- B. *Leiopyrena*.

3. *Meioptila*, bracts equaling the sporangium in length.

II. *Macrocarpa*, nucleus more than 600 μ . in length.

1. *Macroptila*, *microptila* or *meioptila*.
 - A. *Pachygyra* or *Leiopyrena*.
 - a. *Condensata*, *laxior* or *clausula*.

III. *Meiocarpa*, nucleus of medium size, between 500 and 600 μ . long,
Variations as above.

The American forms may be arranged and designated as follows, beginning with those having the smallest nucleus :

1. *Forma tenuior*, *microcarpa*, *microptila*, *unilateralis*, *laxior*, *oxygyra* (var. *Braunii tenera* A. Br.). This form was collected

by Wright in New Mexico (No. 908). It is a slender diffuse

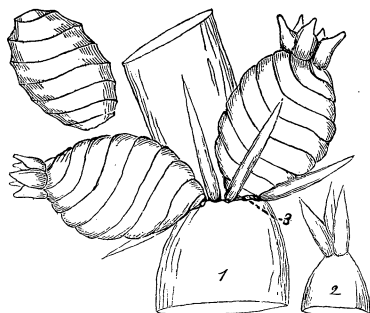


FIG. 1.—Variety *Braunii tenera*.

between var. *Braunii* and var. *Oahuensis* A. Br. The sporangia and antheridia are usually duplicated on each of the two lower nodes. The terminal segment consists of three slender elongated cells forming a tuft. The nucleus is oval with about seven sharp angles, 420 to 460 μ long and about 250 μ broad. In the adjoining cut 1 represents the anterior aspect of a node with two sporangia but with the antheridia removed, as at 3. 2 is a terminal node—all magnified forty diameters.

II. Forma microcarpa, microptila, unilaterialia, laxior (var. *Braunii genuina*). This form has been collected near St. Louis by

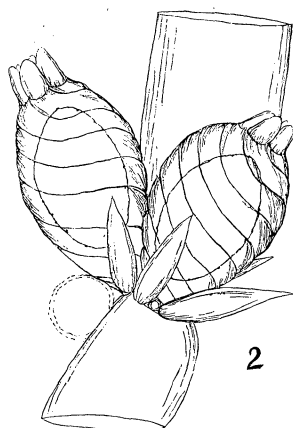
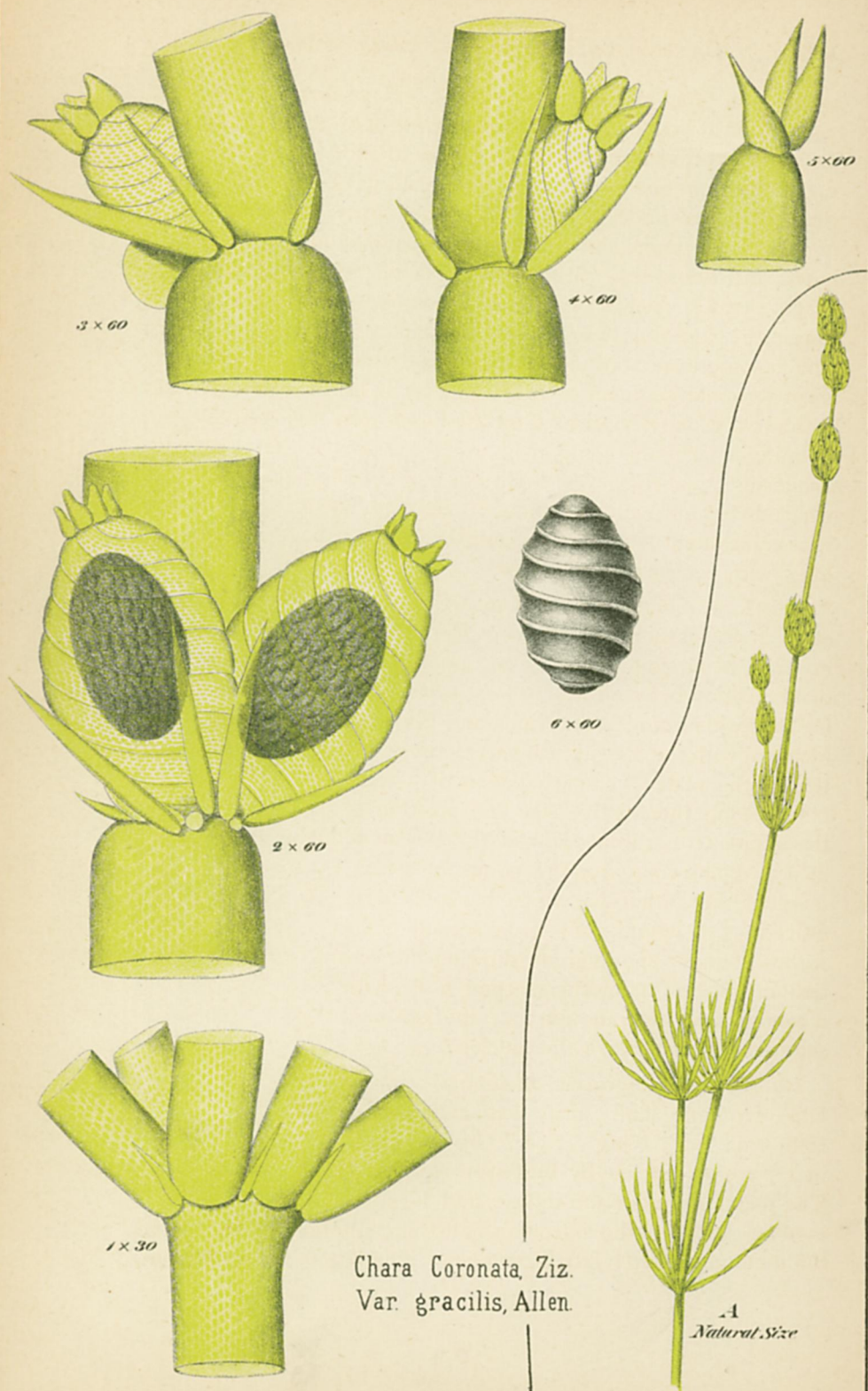


FIG. 2.—Variety *Braunii genuina*. This form has been collected near St. Louis by Dr. Engelmann (to whose kindness I am indebted for specimens). Plants diffuse, leaves longer than the internodes, 4-5 articulations, of which the lowest or the two lowest are fertile; stipules rather stout but short; bracts stout, unilateral, much shorter than the sporangium. Coronula of five connivent, blunt cells. Nucleus broadly oval, 475 to 500 μ long, with about six ribs, which are blunt and not prominent. The accompanying figure, magnified forty times, represents the anterior aspect of a node of a leaf, with two sporangia, one antheridium, in situ (outlined) and one removed; only the anterior bracts are shown, the lateral are about the same length.

III. Forma meiocarpa, microptila, verticillata, elongata, clausa,



Chara coronata, Ziz.
Var. *gracilis*, Allen.

pachygyra (var. *gracilis* Allen ined.). Plant slender, elongated, 15 to 20^{cm} in height. Verticils consisting of 9–10 leaves, distant. Leaves much shorter than the internodes, the lower spreading; the upper fruiting ones connivent; articulations few, usually three, the two lower nodes bearing fruit, the upper sterile, the fertile nodes usually connivent while the subterminal internode is elongated and divergent. Stipules very slender and rather short; bracts slender, usually verticillate, much shorter than the sporangium, the anterior longer than the lateral, the posterior very small, sometimes wanting, the terminal bracts form, with the short terminal segment of the leaf, a triple tuft. Sporangia and antheridia usually duplicated on the two lowest nodes of the leaf. Sporangia large in comparison with the size of the plant, with about eight whorls on one side; coronula of short pointed somewhat divergent cells; altitude of cells of coronula in mature sporangia about 100 μ . Nucleus broadly oval, 480 to 520 μ . long, with five or six thick ribs.

This form differs in habit of growth from all other known varieties. It was gathered near Silver City, New Mexico, by Mr. Rushy in 1880, being found in only one pool. It occupies an intermediate position between var. *Braunii tenera* (Forma 1) and the large fruited forms from Pennsylvania and Kansas, which seem almost identical with the East Indian var. *Coromandelina* A. Br. Explanation of the plate; 1, a partial view of a verticil, showing the relative size and position of the stipules; 2, a front view of the first node of a leaf, showing at *a* the points of attachment of the antheridia which have been removed; 3, a lateral view of a second node, with a younger sporangium, showing the verticillate bracts; 4, another second node, with a very young sporangium; 5, the terminal segment of a leaf; 6, a ripe nucleus.

iv. Forma *microcarpa*, *meioptila*, verticillata, *tenuior*. This form was collected in California, at "King's river," by Berggren

in 1875, and sent me by Professor Nordstedt. The plant is slender and diffuse, and is intermediate between the extreme small-fruited unilateral forms and the medium-fruited verticillate ones. The bracts are verticillate,

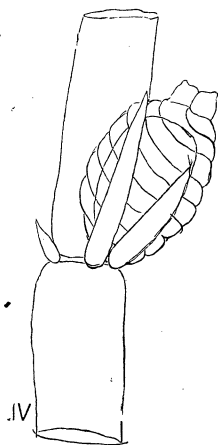


FIG. 4.—*Chara coronata*, var. 4.

the anterior shorter than the lateral, which about equal in length the sporangium; the coronula consists of short thick cells with a minute point, not at all developed as in *Braunii tenera*. Nucleus 425–500 μ . long, with 6–7 angles.

We now come to a group of forms representing in a general way the ordinary var. *Schweinitzii*, though the transition from the short bracted and small fruited forms to the large bracts and large fruit, is gradual. The bracts subtending the sporangium vary in relative length, sometimes the anterior, sometimes the lateral bracts are longer. The form with long lateral bracts has been known as *Chara foliolosa* Schw., the one with shorter bracts but long leaves, as in Form III. as *C. opaca* Schw.

v. Forma macrocarpa, meioptila, verticillata, tenuior, leiopy-

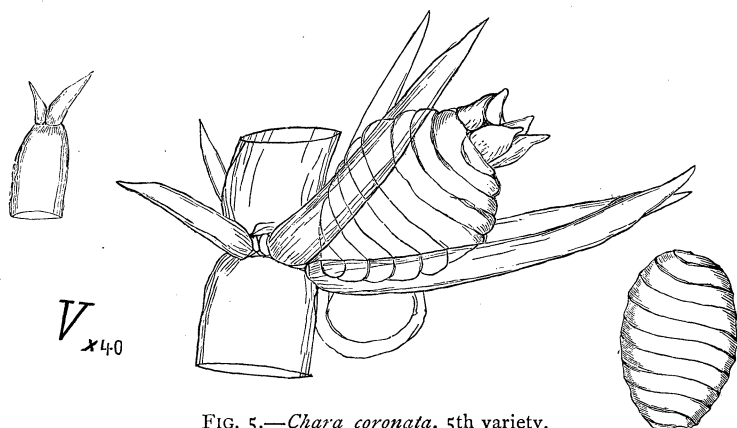


FIG. 5.—*Chara coronata*, 5th variety.

rena. Plant small, diffuse, with elongated leaves of 4–5 articulations; bracts usually verticillate, equal in length to or slightly longer than the sporangium, anterior bracts somewhat longer than the lateral, posterior often nearly as long as the lateral, rarely wanting. Sporangium with 9–11 whorls, coronula of divergent cells with rather long points, similar to *Braunii tenera* of New Mexico (Forma 1). Nucleus 640 μ . long with 9–11 slightly prominent ribs. Saranac lake, N. Y., 1881.

In previous years Professor C. H. Peck, of Albany, collected specimens from precisely the same locality, and in 1860 I sent specimens to Professor A. Braun, who recognized it as a transition form between var. *Braunii* and var. *Schweinitzii*; the ac-

companying drawings are taken from Professor Peck's specimens.

The bracts are shorter and unilateral, the nuclei smaller, $550\ \mu$., but the coronula seems less elongated; whether the plant still continues to vary, remains for farther investigation to establish.

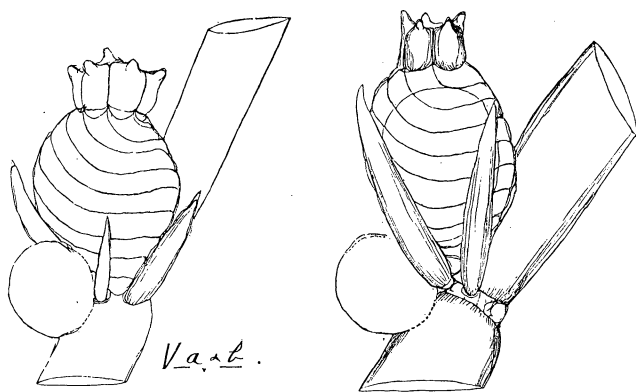
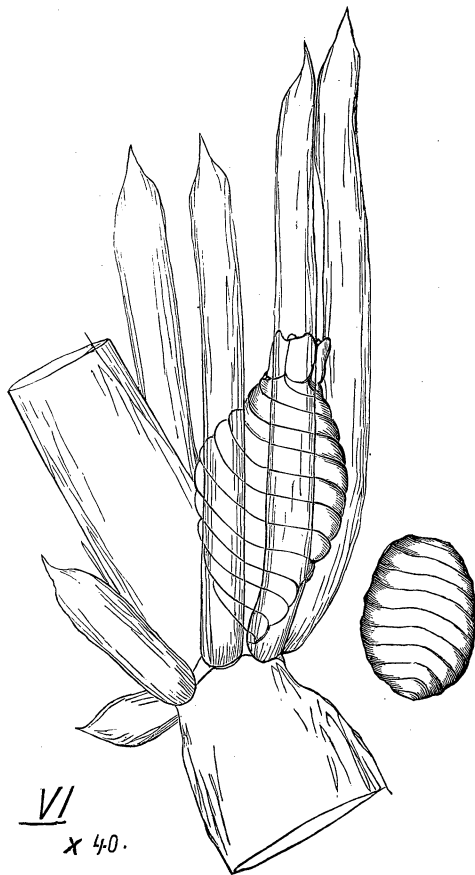
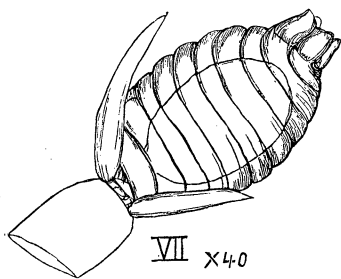


FIG. 6.—*Chara coronata*, 5th variety, a & b.

vi. Forma macrocarpa, macroptila, verticillata, laxior, leiopyrena. This very common northern form was collected in Canada by Professor Macoun; it is slender, diffuse, with long leaves of 4-5 articulations, verticillate bracts much longer than the sporangium, often two or three times its length, the anterior bracts longer than the lateral, the posterior large but much shorter. Nucleus precisely like the Saranac form (v), and about the same size, 620-650, ribs 9-10, scarcely prominent.

One collection of this form from the far west of Canada is completely incrustated with lime, and when dry is gray and very brittle; another from Eastern Canada has a peculiar zonular incrustation but usually the plant is perfectly smooth even in water containing considerable lime. The habit of growth varies exceedingly, some are delicate, diffuse and pellucid, others stout, thick, compact, and in deep water often attain a length of 4 to 5 feet (Litchfield lake, Ct.). This is our most common form, though the cells of the coronula are usually connivent, as in the next form, and the bracts may be unilateral on some nodes of the same plant.

FIG. 7.—*Chara coronata*, 6th variety.FIG. 8.—*C. coronata*, 7th variety.

VII. Forma meiocarpa, microp-tila, unilateralia, laxior. This form was collected at Brattleboro, Vt., by the late C. C. Frost, it presents no differences from the last except the short unilateral bracts, smaller nucleus, 550–600, with fewer ribs, 7–8.

VIII. Forma meiocarpa, meioptila, partim unilateralia, cellulis coronulæ sporangii conniventibus, condensata. Plants compact,

rather stout, verticils approximate; stipules large, inflated, equaling the leaves in size. Bracts inflated, about equal in length to the sporangium or somewhat shorter, mostly unilateral, sometimes verticillate; leaves with 5-6 nodes, the three lower usually fertile; sporangium with about nine whorls on one side, *coronula connivent blunt*; nucleus nearly smooth with about seven angles, 550-575 μ . long. Collected in Vermont by Mr. Horsford.

From Hillsborough, N. C., have been collected specimens by Mr. Curtis (communicated by Dr. Engelmann) of

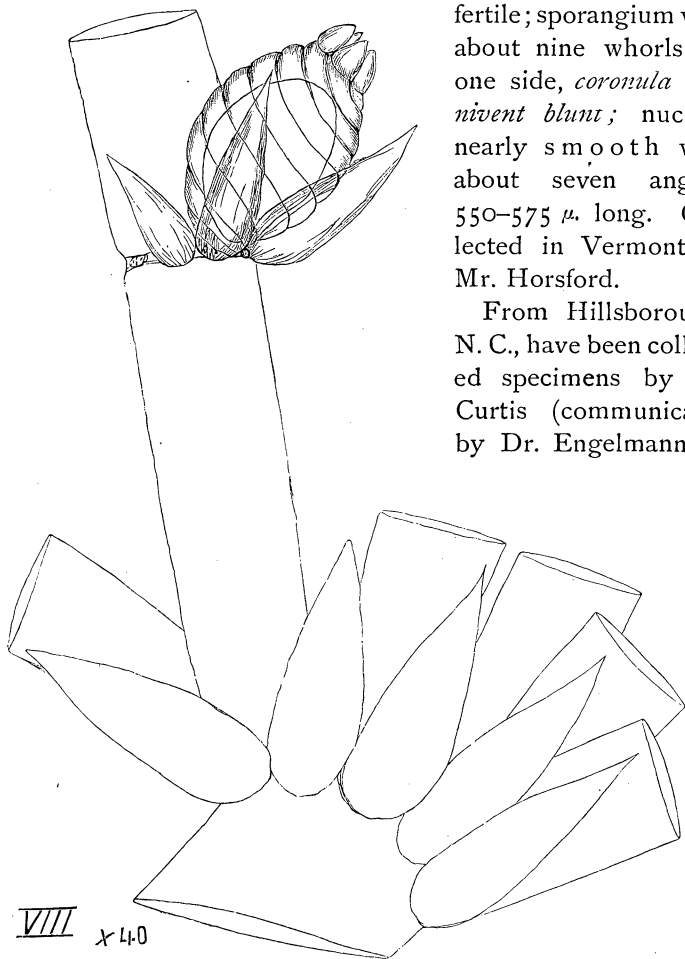


FIG. 9.—*Chara coronata*, 8th variety.

a form almost identical with this one, except that the leaves have only three nodes, the lower of which is fertile, *the upper much elongated*, and the bracts commonly verticillate and somewhat narrower.

ix. *Forma macrocarpa, microptila, verticillata*. The plants belonging to this form are remarkable for the large size of the fruit

and the small verticillate bracts. The specimens from Pennsylvania

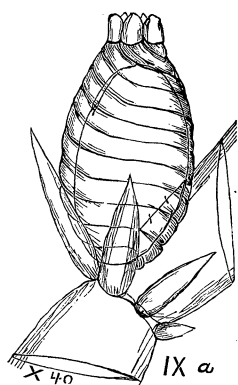


FIG. 10.—*C. coronata*, 9th var.; a.

were collected "in a flume" by Mr. E. A. Rau. The plants are diffuse, thin and transparent; stems long; verticils approximate at upper part; leaves long, spreading, with two fertile nodes and 2-3 sterile; the upper internodes much elongated. Bracts much shorter than the sporangium, verticillate, the anterior longer than the lateral; coronula of the sporangium consisting of connivent blunt cells; nucleus elliptical, about twice as long as broad, 650 μ . long, with nine faint striæ. Very similar to this, apparently, is a form from Kansas, collected by Fendler and com-

municated to me by Dr. Engelmänn, of St. Louis. The leaves are long, consisting of four nodes, of which the lowest is fertile; the upper considerably elongated. The bracts are less than half the length of the sporangium, verticillate, *the anterior shorter than the lateral*;

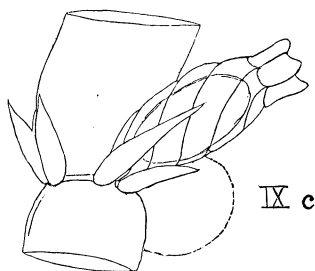
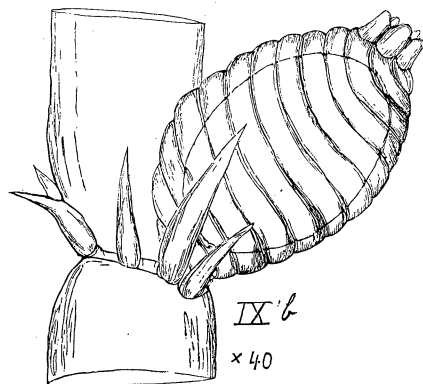


FIG.—*Chara coronata*, 9th variety; b, c.

coronula with blunt somewhat connivent cells, the sporangium large with about twelve whorls on one side. Nucleus gigantic in size, 760-780 μ . long with 9-10 faint striæ. This form is truly western in the enormous development of nucleus, but in no other respect does it seem to differ from eastern forms. *b*, a mature fruit; *c*, very young, showing a large antheridium. The figures have all been drawn with the camera lucida from actual specimens, and are perfectly true to nature.

To these forms we have been able to refer all the specimens

which have thus far been collected in America; they seem to illustrate the futility of attempting to define satisfactorily varieties, and to warrant their abandonment and the substitution of "forms," varying with the locality, as has been suggested by Professor Nordstedt, of Sweden, and is the practice in the case of the polymorphous species, *C. fætida* A. Br., *C. intermedia* A. Br., and many others.

A few of the more remarkable forms may still retain a specific name, as var. *Oahuensis* A. Br., perhaps var. *gracilis* Allen, and a few others; or it might even be admissible to bestow a specific name on each constant form as a convenient method of designating its peculiarities. For the present, however, while our knowledge of the American forms is yet so incomplete, we prefer to classify them as above.

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THE LOESS OF NORTH AMERICA.

BY R. ELLSWORTH CALL.

THE term loess is a purely provincial one, having been originally applied by the residents of the Rhine valley to a certain comparatively recent formation bordering that stream. It is the anglicized form of the German *löss*, itself a derivative of the verb *lösen*, to loose or to detach. It was evidently bestowed in allusion to the loose texture of that loam-like soil, and, in its present acceptation, is to be regarded as nearly the equivalent of the English *loam*.

Historical.—The earliest notice of the loess in America appears to have been in connection with various exploring expeditions sent out by the General Government. That of Lewis and Clark, made between the years 1803–1806, to the Rocky mountains, by way of the Missouri river, called attention to the remarkable character, both physical and lithological, of the bluffs along that stream, but for aught the report contains their true geological position and history were not recognized. Later, the celebrated artist, Catlin, in his letters to England from the Northwest,¹ gives a very accurate and graphic account of the Missouri river bluffs, in which he mentions certain of their remarkable physical peculiarities.

The real geological character of this formation in the United

¹ Catlin's N. A. Indians, Vol. I, p. 19, 1876. London, Chatto & Windus.